

REMARKS

Claims 26-33, 35, 37, 38 and 41-44 are pending in the application. In the Office Action mailed December 7, 2009, claims 26-33, 35, and 43-44 are rejected, and claims 37, 38, 41 and 42 are allowed. In the instant Amendment, claims 26 and 27 have been amended.

Claims 26 and 27 have been amended to recite that the dehydrated material is optionally shaped, in order to provide antecedent basis for the shaping step recited by dependent claim 31. Support for this amendment is found in the specification, for example at page 24, lines 9-16.

Claims 26 and 27 have also been amended to recite reducing said dehydrated material in the rotary hearth type reduction furnace. Support for this amendment can be found throughout the specification, for example, at page 15, lines 32-33.

No new matter has been added by these amendments. Entry of the amendments and consideration of the following remarks are respectfully requested.

Rejection under 35 U.S.C. § 103

Claims 26-30, 35, 43 an 44 are rejected under 35 U.S.C. § 103(a) as being allegedly obvious over JP 50101202 A to Miyashita (“JP’202”) based on English written translation in view of US Patent No. 4,525,208 to Yasukawa (“US’208”) and JP Publication No. 2001-033173 A, abstract and machine translation (“JP’173”).

Claims 31-33 are rejected under 35 U.S.C. § 103(a) as being unpatentable over JP’202 patent in view of US’208 and JP’173 as applied to claims 26 or 27 above, and further in view of US Patent No. 6,755,888 to Ibaraki et al. (“US’888”).

The presently claimed invention is directed to a method of reduction treatment of metal oxides using a feed material containing metal oxides, alkali metals and halogen elements. The claimed method includes the steps of mixing the feed material with water to produce a slurry, dehydrating the slurry, optionally shaping the dehydrated material, optionally mixing the dehydrated material with an additional feed material, and then charging the dehydrated material or the mixture into a rotary hearth type reduction furnace and reducing the dehydrated material or the mixture in the rotary hearth type reduction furnace.

The claimed method can also include a step of recovering the secondary dust from the exhaust gas for use as a feed material for concentrating and recovering zinc and/or lead.

As the present specification discloses, when using a feed material including zinc, lead, alkali metals and halogen metals, special consideration is required. See, specification at pg. 3, final paragraph. Specifically, it has been found that if the exhaust gas of a rotary hearth type reduction furnace contains a large amount of sodium chloride, potassium chloride, or other alkali metal halides, (i) these substances deposit as dust inside the exhaust gas treatment system and become factors inhibiting operation, and (ii) that the concentration of zinc in the dust falls and the value as a zinc feed material falls. See, specification at the paragraph bridging pages 3 and 4. The prior art has presented methods of controlling the sources of the feed material and of modifying the exhaust gas treatment system to avoid the above problems. Specification, pages 4-8.

The present inventors have discovered that by including the pre-reduction treatment steps as recited in the claims, the above-mentioned problems (i) and (ii) can be avoided. Thus, the presently claimed method allows utilizing feed materials containing zinc, lead, alkali metals and halogens using a rotary hearth type reduction furnace without depositing inorganic zinc, lead, or alkali metal compounds of oxygen or halogens, or mixtures thereof, inside the rotary hearth type reduction furnace and provides a secondary dust enriched in zinc. See, specification, e.g., page 29, line 35 through page 30, line 2.

In contrast, JP'202 is not concerned with solving the problems associated with reduction of feed materials containing zinc, lead, alkali metals and halogens using a rotary hearth type reduction furnace. JP'202 discloses a method for recovering valuable metal from open-arc steelmaking dust by providing a sintered iron ore containing zinc and lead free of chlorine, sodium, potassium and fluorine. The method of JP'202 includes washing the dust to remove the chlorine, sodium, and potassium, adding coke to the washed dust, granulating, and sintering the same to obtain sintered iron ore containing zinc and lead, useful for further processing. See, JP'202, Abstract. JP'202 does not teach or suggest charging a dehydrated material directly into a rotary hearth type reduction furnace and reducing the material as presently claimed.

In particular, the inventive contribution of JP'202 is to overcome the difficulty of removing fluorine from the composition by "employing a sintering stage between the water washing and alkali washing stages and carrying out these stages successively as a

process." JP'202 further emphasizes that the success of the disclosed method requires "the respective stages of water-washing, sintering and alkali washing in a successive manner, *and it is not a simple combination of those stages.*" Emphasis added. JP'202, at page 7, lines 8 through 16.

Thus, JP'202 requires performing all three steps of washing, sintering and alkaline washing sequentially. However, sintering and subsequent alkali washing of the sinter dust are not included in the present method. A person of ordinary skill in the art would not have modified JP'202 in order to arrive at the present invention for at least the reason that eliminating the sintering step would render the JP'202 invention inadequate for its intended purpose of eliminating fluorine and cadmium from the iron and zinc containing ore.

Further, JP'202 does not teach or suggest the use of a rotary hearth type reduction furnace for the reduction of mixed metal oxides and vaporization of zinc. Instead, JP'202 teaches that the iron, lead and zinc that remain in the provided sintered ore may be recovered by heating the ore with cokes in a *distillation furnace* allowing zinc to evaporate, be oxidized and recovered as zinc oxide, and that the resulting ore can then be treated in an *electric furnace* where the iron and lead can be separated in their molten state. See, JP'202 at page 8, lines 10 through 15. Thus, JP'202 does not teach or suggest the problems of reducing a feed material containing metal oxides and alkali metals and halogen elements in a rotary hearth type reduction furnace for reduction. Nor does JP'202 teach or suggest a method for solving such problems. Applicants respectfully direct the attention of the Examiner to the specification at page 7, line 34 through page 8, line 15 for a detailed discussion of JP'202 Publication No. 53-29122 and its differences from the present invention.

The Examiner has applied US'208 for allegedly teaching a rotary hearth furnace for the reduction of the JP'202 dust since US'208 teaches a high ratio of zinc and lead. Although US'208 discloses a similar problem, i.e., the deposition of material inside a rotary hearth reduction furnace, US'208 teaches solving the problem by conducting a preliminary reduction step to volatilize Zn and Pb at a lower temperature incapable of inducing formation of deposits on the furnace wall. See, US'208 at column 3, lines 49 through 52. The product of the preliminary reduction step, a feed material with a minimized amount of Zn and Pb, is then charged into the rotary hearth reduction furnace which is maintained at 1200° to 1350°C. See, US'208 at column 3, lines 50-56. US'208 does not teach or suggest the that by including the pre-reduction treatment steps as recited in the claims, without using a preliminary reduction in a rotary kiln, the problems of material

deposition and loss of zinc and lead can be avoided. Thus, US'208 does not teach or suggest the presently claimed invention. In addition, to arrive at the presently claimed invention, a person of ordinary skill in the art would have to modify US'208 by eliminating the preliminary reduction step. Such a modification would have rendered the method unsuitable for US'208's own purpose.

Thus, in order to arrive at the presently claimed invention, a person of ordinary skill in the art would have to combine the washing step of JP'202 with the reduction step in a rotary hearth furnace, while modifying JP'202 to eliminate the sintering and alkaline washing stages and modifying US'208 to eliminate pre reduction step in a rotary kiln prior to reduction in a rotary hearth furnace. Neither of the references provide a reason to a person skilled in the art to make such modifications/combination. In addition, both the modification to JP'202 and the modification to US'208 would have rendered the modified methods unsuitable for the respective references' own purpose. Neither of the references provides a person skilled in the art any expectation that such modifications/combination would solve the problems of material deposition inside a rotary hearth reduction furnace and loss of zinc/lead.

JP'173 discloses a method for preventing the buildup of dust generated from a rotary furnace charged with raw materials such as iron oxide, alkaline metal, zinc, lead, other volatile metal and chlorine. See, JP'173, paragraph [0009]. Specifically, JP'173 teaches that to prevent dust deposition, a dust stripper is installed in the waste boiler 3 and the heat exchanger 5. JP'173, paragraph [0014]. JP'173 does not teach or suggest the method of the present invention. The Examiner has applied JP'173 for allegedly teaching a rotary hearth furnace with a waste heat boiler of the present invention. Therefore, JP'173 does not supply what are missing from JP'202 and US'208.

US'888 provides a reducing furnace of the rotary hearth-type and a method for reducing a metal oxide simplified in the process from dehydration to molding, according to which a moisture-rich powdery raw material is reduced at low cost. See US'888, Abstract. However, US'888 does not consider alkaline and halogen bearing feed stocks. US'888 does not teach or suggest the method of the present invention. The Examiner has applied US'888 for allegedly teaching a dehydrated material shaped into articles having a porosity of at least 35%, a moisture content of 15-30%, the recited ratio of carbon to oxygen. Therefore, US'888 does not supply what are missing from JP'202, US'208 and JP'173.

Thus, claims 26-33, 35, 43 and 44 are not obvious under 35 U.S.C. § 103(a) over JP'202, US'208, JP'173 and US'888.

It is submitted that in view of the present amendment and foregoing remarks, the application is now in condition for allowance. It is therefore respectfully requested that the application, as amended, be allowed and passed for issue.

Respectfully submitted,

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